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Rocks and Minerals

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A Magazine for Mineralogists, Geologists and Collectors

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December, 1941

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To stimulate public interest in geology and mineralogy and to endeavor to have courses in these subjects introduced in the curricula of the public school systems; to revive a general interest in minerals and mineral collecting; to instruct beginners as to how a collection can be made and cared for; to keep an accurate and permanent record of all mineral localities and minerals found there and to print same for distribution; to encourage the search for new minerals that have not yet been discovered; and to endeavor to secure the practical conservation of mineral localities and unusual rock formations.

Ever since its foundation in 1928, the Rocks and Minerals Association has done much to promote the interest in mineralogy. It has sponsored outings, expeditions, formations of mineralogical clubs and the printing of many articles that have been a distinct contribution to mineralogy.

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A list of affiliated clubs will be found among the back pages of the magazine.

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PUBLISHED MONTHLY

Edited and Published by
PETER ZODAC

December
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ROCKS and MINERALS PEEKSKILL, N. Y., U. S. A.

The Official Journal of the Rocks and Minerals Association

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The advertising pages of this issue of ROCKS AND MINERALS is crammed full with captivating items—gorgeous mineral specimens—lovely gems—intriguing crystals—rich ores—interesting rocks—fascinating books and magazines—excellent lapidary equipment and supplies—astounding ultra violet lamps—all attractively priced for the Christmas season! Where else in this country can you find a wider and better assortment of mineralogical items than among the stocks of those dealers who advertise in ROCKS AND MINERALS?

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This is the month when in spite of wars and rumors of wars, and in spite of what your worries and ours may be, will run the fine golden vein of thought of the approaching Christmas season and the song the angels sang, "Peace on earth good will to man."

In our own busy little workshop, preparing this issue for the readers of **Rocks and Minerals,** our thoughts have been with you, wishing you peace, joy and fulfillment of your hearts' sincere and greatest desires.

So a Merry Christmas to you who read these lines—a Merry Christmas and a Happy, Prosperous New Year!

Peter Zodac

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The Official Journal of the ROCKS and MINERALS ASSOCIATION

Whole No. 125

COLLECTING SEMI-PRECIOUS STONES IN FLORIDA*

By JAMES G. MANCHESTER

INTRODUCTION

Many years ago the writer acquired a mineral specimen labelled "Chalcedony Pseudomorph after Coral, Tampa, Florida." This particular specimen was so attractive that throughout all these years he has had a desire to visit the locality from whence this mineral came. Now that this desire has been achieved and many delightful hours have been spent collecting minerals in the vicinity of Tampa, the writer feels that a brief description of one collector's experience may be of interest.

For a great many years the writer has been collecting minerals, as an avocation, in mines, quarries and rock excavations in New England and the Middle Atlantic States and the experience in the Tampa area is the culmination of all previous collecting. No attempt is made in this paper to write a survey of the locality, or to make any scientific interpretation of the same. The literature bearing on the deposit is voluminous and has been covered by those whose training and knowledge fit them for the work. However, these reports have been confined to the geological and paleontological features, the mineralogical aspects having received only a passing reference. It is on this account that the writer has endeavored to summarize briefly, in a simple story, his own observations of a feature of the deposit not heretofore covered by other investigators.

The illustrations used herewith are of specimens personally collected that appeared to be the best of their particular types and species. For the identification of the fossil corals used in the illustrations thanks are due to Prof. Dana Wells, of West Virginia University.

BIBLIOGRAPHY

The earliest mineralogical reference to the Tampa area found by the writer is contained in a list of mineral localities published by Robinson[1] in 1825, who notes under the heading of Tampa Bay: "Coral, mineralized, in chalcedony and cacholong is found near this bay", and he also notes that "hornstone, flint, agate and chalcedony occur in the southern part of the secondary district."

Phillips[2] in 1844 notes that "Hollow globular masses of reddish brown and yellow botryoidal chalcedony occur at Tampa Bay, Florida."

In 1846, Prof. John H. Allen[3], a former lieutenant of artillery in the United States Army in Florida, wrote an interesting account of his observations and listed a number of localities in the Tampa area in which these fossil corals are found "petrified with clear wine colored silex, and having a mammillary interior of carnelian or chalcedony." A footnote to this article by the editors of the Journal says "These beautiful fossils are well known in mineralogical cabinets as chalcedony from Tampa Bay."

Allen's account was followed a few months later by T. A. Conrad[4] with a published report of an expedition to Florida in the Winter of 1842 under the sponsorship of the United States Navy,

*Based on an address delivered at a convention of the Rocks and Minerals Association, held at Peekskill, New York, June 17, 1939, illustrated by lantern slides and specimens.

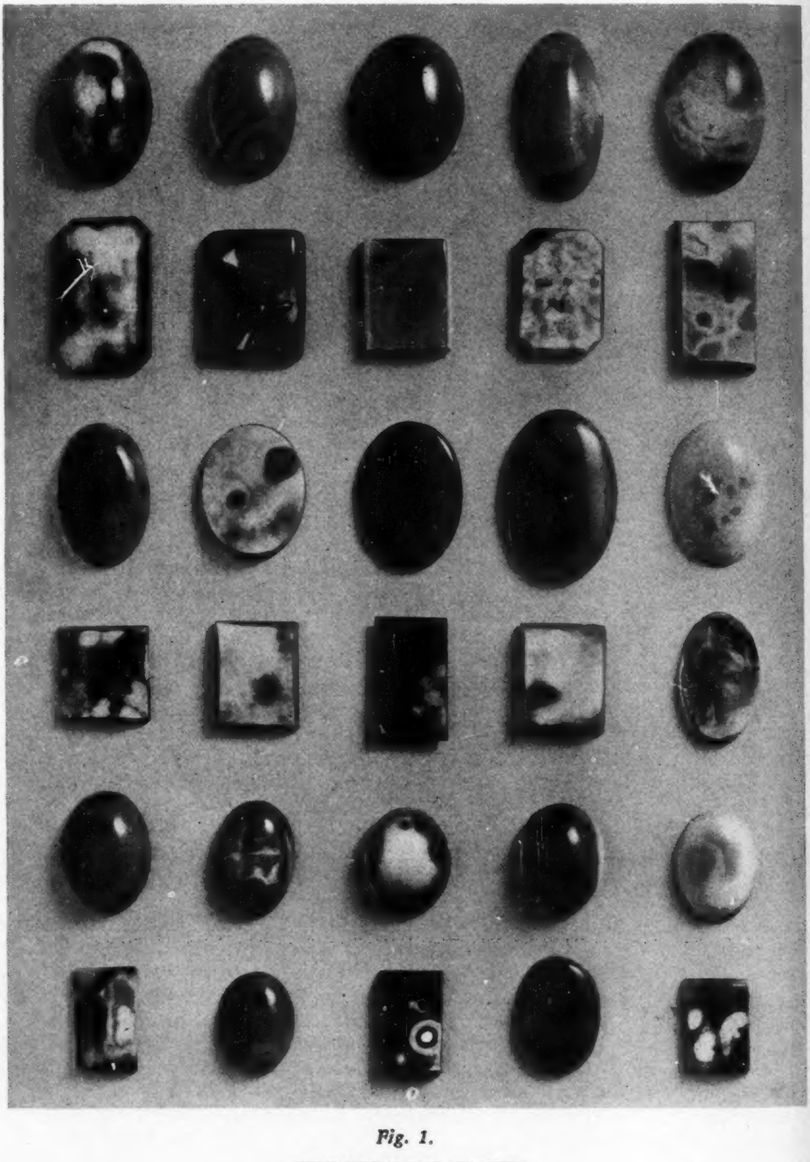

Fig. 1.

SEMI-PRECIOUS STONES

Cut from Chalcedony Pseudomorphs after Coral, collected at Ballast Point, Hillsborough Bay, Tampa, Florida. Noted among the varieties of Chalcedony are Carnelian, Sard, Sardonyx, Black Onyx, and Agate. (x 6/7).

destined for a survey of Tampa Bay. This expedition sailed along the coast of the Florida peninsula and after many stops arrived in Tampa Bay. Conrad's interest was in shells and little is said of the minerals. Ballast Point is referred to as follows: "This point has been much resorted to for procuring chalcedony of ususual beauty, formerly very abundant, but fine specimens are now rare."

Dana[5] first reports this locality in the third edition of his *System of Mineralogy,* published in 1850, wherein he notes under mineral localities: "Florida, near Tampa Bay: limestone, sulphur springs, chalcedony, carnelian, agate, silicified shells and corals."

In 1886, the Wagner Free Institute of Science and the Academy of Natural Sciences of Philadelphia financed an expedition to Florida, made up of a number of scientists, besides the master and crew of a small sailing vessel on which the trip was made. The results of a visit to Ballast Point were later published[6] as part of a report of the expedition.

The most extensive report on the fauna of the Ballast Point area was a monograph by Dall[7] published in 1915.

The above have been followed by other investigators. Dr. T. Wayland Vaughan, a leading authority, has written many papers bearing on reef corals, coral formations, etc., and in these he refers frequently to the Florida corals. Dall, in his monograph, includes a list of 17 corals of the Ballast Point area identified by Dr. Vaughan, and several of these were later described by that gentleman[8].

The most recent extended reference to Ballast Point is contained in a report by Cooke and Mossom published under the supervision of Herman Gunter, Florida State geologist[9].

The territory of Florida did not become a part of the United States until 1822, thru its purchase from Spain. It was in 1823 that the United States troops sailed into Tampa Bay and built a log fort as headquarters in the then current war with the Seminoles. This fort was named Fort Brooke and was located at the junction of Hillsborough River and Hillsborough Bay, a few miles to the north of Ballast Point, where now is the business center of the City of Tampa. The little settlement that grew up in those early days was known as Fort Brooke, the Indian name of Tampa being adopted later. As previously noted the first published reference to Tampa as a mineral locality was in 1825, so it would appear that the deposits of the area received much attention in those early days. These explorations were carried on from vessels fitted out in the North, as the railroad did not enter the area until 1885. Tampa in its early days was an obscure fishing village and did not appear in the United States census until 1870, when it was credited with a population of 796[10]. It is now a thriving community with a population in excess of 100,000.

LIFE STORY OF CORAL POLYPS

Let us pause for a few moments to consider the life story of these coral animals whose fossils we are now considering and which thrived millions of years ago in Floridian waters. These minute organisms that have played such an important part in the building up of so much land areas in various parts of the country, lived and died, leaving skeletons that to-day are the foundation props of great cities.

The life story of coral polyps has been interestingly described by Dr. Roy Waldo Miner[11] and Dr. T. Wayland Vaughan[12]. Coral polyps increase and multiply by budding and splitting. Young buds sprout from the body of the parent polyp and remain connected with it. In other instances a jelly-like sac is thrown off from the parent polyp, pear shaped, very small about half a millimeter in diameter and about a millimeter long; this free swimming lava finally attaches itself to a hard object on the bottom of the bay or shallow sea. As a protective covering for its delicate body it combines carbon dioxide, which it gives off, with the lime in the sea-water, forming a skeleton of carbonate of lime. But unlike the skeletons of other animals, this skeleton

is on the outside of the body and this hard substance is what we know as coral. A single polyp will multiply in time to form a good sized colony, made up of countless compact individuals reaching from the floor of the bay or sea to the surface of the water.

There is another interesting feature associated with the life of reef-forming polyps the biological phenomenon known as symbiosis, a term applied to describe a situation where two dissimiliar organisms exist side by side for the benefit of both. In this case microscopic marine plants or algae, live in the inner tissues of the polyp wall. The polyps excrete carbon dioxide, quite necessary for the growth of plants, and the algae in turn give off oxygen, quite essential for animal existence. These algae, together with the waving tentacles of the polyps, are no doubt responsible for much of the coloring noted in living corals when viewed in their natural habitation. The flower-like appearance of coral animals has been responsible for the belief that they are marine plants; and it is amusing to read of the little patience scientists have for those laymen who still adhere to this belief.

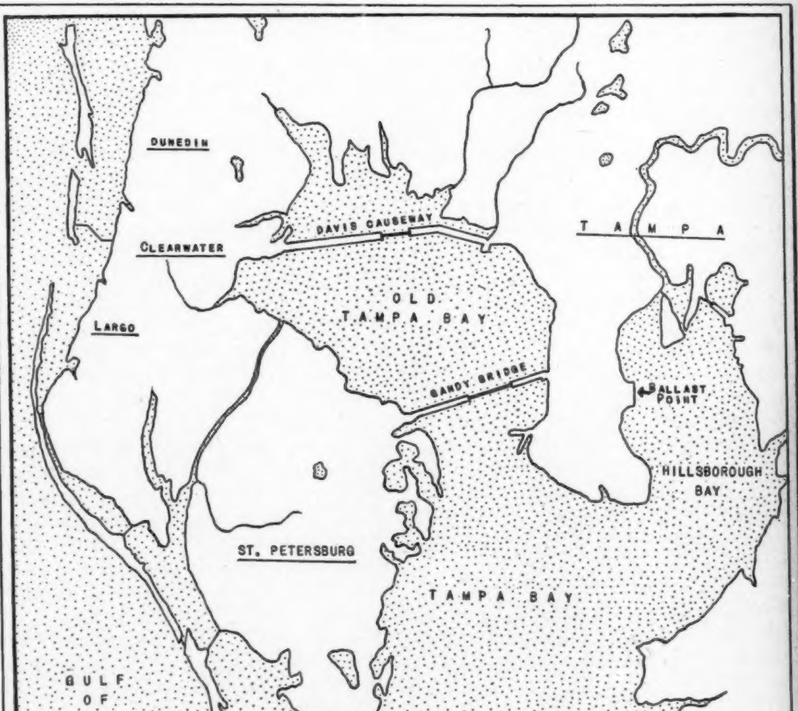

Fig. 2. Map of Tampa, Florida, and vicinity, showing location of the "silex bed" at Ballast Point, Hillsborough Bay.

ANCIENT TIMES IN THE TAMPA AREA

Let us try to visualize conditions as they existed in the waters about Tampa millions of years ago. No doubt the scene was similar to that on the living coral reefs which exist to-day off the southern end of the Florida peninsula, in the Bahamas and in the Bermudas, where vast masses of rock are being formed by the continuous growth of coral polyps. These particular polyps, tiny creatures tho they are, known as reefbuilders, are the foremost builders in the realm of Nature. Similar animals are responsible for much of the rock that make up the foundation floor of the Florida peninsula. In ancient times the Tampa area must have been well covered with these coral reefs, for to-day the shores of the adjacent bays give evidence that such a condition must have existed at one time.

METASOMATISM

Coral animals when they die leave skeletons of lime, and these are called fossils. The average mineralogist, or mineral collector, is not interested in these fossils unless the phenomenon known as metasomatism has taken place. This is a term applied where a new mineral replaces the primitive one. The facility with which these fossils undergo metasomatic action is no doubt due to the chemical action of the tropical waters, which are relatively heavily charged with dissolved silica. Further, it is reported by investigators that some species of living coral extract much silica from seawater. So silica, the petrifying medium, was present both within and without the coral polyp in its natural state.

In the clay and sea-water which covered these dead animals in the Tampa area there was also much dissolved silica,

Fig. 3. "Silex bed" at Ballast Point, Hillsborough Bay, during low tide. Mounds of clay, marl and chert covered with mollusca and other marine growth. Davis Island and the business center of Tampa in middle background.

which, over a long period of time, has replaced the limy corals in the form of a quartz mineral known as chalcedony. The resulting stone resembles a pseudomorph (a term applied to a mineral which has been changed into another mineral without losing its original form); hence the name "Chalcedony pseudomorph after Coral" by which they are known. Some of these stones have a geodic form while others have the shape of the more familiar branching variety of coral.

There is much evidence that this metasomatic action is going on at the present time. Dall[13] reports "a test was made which showed that in cases where part of a fossil shell projecting from a limestone pebble between tides, where the water was gradually dissolving the limestone and exposing the fossil, the still-imbedded portion of the shell retained its limy character, while the exposed portion had been completely replaced by silex." In the Tampa area, where blocks of limestone have been brought to the shore to be used for breakwater purposes, the writer has noted silicified shells on the surface of the limestone which is reached by tidal waters, but when these blocks of limestone are broken no silicified shells are apparent, the newly exposed shells, or casts, being composed of the usual carbonate of lime.

The strata containing the remains of these ancient corals come to the surface, and are exposed at low tide at several points in Hillsborough Bay, but for the purpose of this story two deposits only will be noted, those at Davis Island and Ballast Point.

DAVIS ISLAND

Davis Island, located at the northerly end of Hillsborough Bay, at the entrance to Hillsborough River, was brought into existence in 1924 by D. P. Davis, a real estate promoter, who dredged enough sand and clay from the bottom of the bay to create an island

Fig. 4. West shore of Hillsborough Bay at Ballast Point, looking north, during low tide, showing limestone fragments and fossil corals cast upon the shore.

Fig. 5. Chalcedony pseudomorph after Coral (Antiguastrea sp). Left: Outer surface of the corallum showing nature of the corallites. Right: Interior of the same specimen showing position of growth and tubular character of the corallites. This unusual and rare view of a longitudinal section is made possible by the fact that only a part of the corallum had been silicified, the softer remains of the exoskeleton having been carried away in solution, or scoured by beach sands. (x 7/10).

covering several thousand acres. In this clay and sand were found the silicified shells and corals and for a while it was a favorite spot for collectors. Mr. Ernest Weidhaas, a fellow-collector of New York City, successfully worked the locality for several seasons, obtaining a bountiful supply of interesting material. This land has now become overgrown with tropical vegetation and specimens are no longer easily obtainable.

BALLAST POINT

The area that received the attention of the writer was Ballast Point, located on the westerly shore of Hillsborough Bay, about three miles from the business center of the City of Tampa and within the corporate limits of that city (Fig. 2). The point juts for a short distance into the bay and is about three-quarters of a mile long. The shore is lined with much tropical vegetation, among which many residences have been erected. The beach is sandy in spots but is covered mostly with limestone fragments more or less mingled with clay, marl, flint, chert and sand, which is extremely fossiliferous. Along this shore is located the famous "silex bed" (Fig. 3), a place name it has retained to the present time notwithstanding the attempt to designate the locality as the "orthaulax bed"[14], after a rare species of fauna found in only a few localities in North and Central America.

COLLECTING

Although this locality has long been known to collectors and has been the mecca of geologists and paleontologists for over one hundred years, it is still possible to collect specimens. One's time is somewhat limited, as the specimens are uncovered only during a very low tide. The lower the tide, the better the opportunity to collect (Fig. 4). The almanac will name the time at which low tide should prevail, but local conditions prove otherwise. One must rely upon the prevailing wind and condition of the water. A strong south or southeasterly wind for a few days will bring in the water from Tampa Bay; and low tide does not mean anything until there is a northerly or westerly wind to carry the water out of the bay or away from the shore. Then again the phase of the moon must be taken into account, for it is known that the moon influences tidal action. It is seldom that the wind, the tide, the water and the moon will coöperate for the benefit of a mineral collector. However, when the weather is unusual for Florida, that is, when the weather is cold, it generally means that conditions should be just about right for collecting.

A stroll along the shore does not at first show much promise, as the material is made up mostly of unattractive looking stones that ages ago were a part of the coral reef. However, among this material are found the chalcedony pseudomorphs after coral much sought after by discriminating collectors. These fossils, like the fragmentary materials that lie within the tidal waters, are covered with oyster shells, sea-weed and other marine growth. At first it is difficult to distinguish the specimens desired, but upon close examination one can identify the coral fossils by their shape, some spherical or mushroom-like, others finger- or branch-like in appearance. If these are not completely covered with marine growth, or if the fossil has not been scoured by beach sands, one can see evidences of a coral skeleton characterized by the multitude of pit-like calices or valleys on the outer surface that have been retained with more or less detail notwithstanding their great age (Fig. 6).

The best specimens are obtained by excavating in the silex bed. Altho such specimens are not plentiful they are well worth the extra labor. On a number of occasions the writer has uncovered the spherical fossil corals properly oriented in the clay. This leads one to come to the conclusion that here is a part of the original coral reef and that when the coral animals in this vicinity were destroyed their destruction was of a sudden nature, probably due to diluvial action, great floods bringing in much clay, marl and sand to smother the animals; or possibly to a sudden change in the temperature of the water, for it known that coral polyps will not survive a tempera-

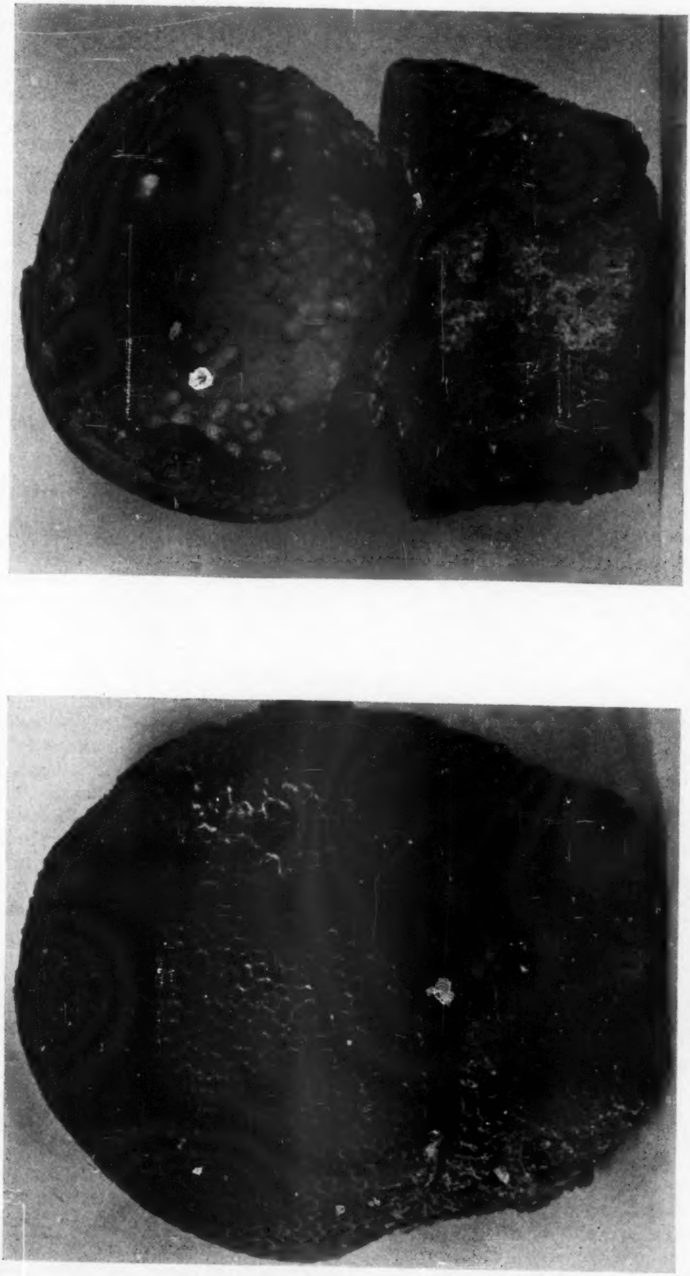

Fig. 6. Chalcedony pseudomorph after Coral (Goniastrea sp). Left: Complete corallum showing nature of the corallites. Right: Interior of the same specimen showing that it had undergone a process of deterioration which produced Chalcedony in varying colors. (x 5/9).

ture lower than 68° Fahrenheit. The finger- or branch-like corals, being much lighter in weight and more friable than the heavier rounded ones, are found lying about in all sorts of positions.

It is customary for one making his first visit to this locality to start in to break open the specimens. Upon opening a spherical or mushroom-shaped specimen one finds that the internal structure of the skeleton has been carried away in solution and the resulting cavity filled with clay; upon removal of this clay there will be disclosed the hard mineral chalcedony in the familiar botryoidal outline (Fig. 7), presenting a remarkable coloration in several of the various shades of red, brown, blue, black, yellow or white. Here he sees the semiprecious stones, sard, sardonyx, black onyx, carnelian or agate, in their natural state, without the addition of any artificial coloring.

When other stones are broken open out will run a fluid, which was locked up when the regular deposition of the silica closed the openings in the soft body of the coral polyps that admitted the water. There, glittering and sparkling in the sunlight, are the lustrous facets of quartz crystals lining the cavity, superimposed on a background of chalcedony (Fig. 11). The effect is heightened by the various colors of the chalcedony visible thru the transparent crystals, giving the crystals the appearance of being red, brown, black or yellow, as the case may be. Out of the many specimens opened by the writer not one drusy quartz lined geode was found containing clay or marl; and nearly all enclosed more or less liquid. The crystals lining some cavities are microscopic, giving the specimen a velvety sheen.

The collector soon finds that it is best to take the specimens home for a more careful examination after removal of the clay, marl or shells adhering to the outer surface. Parts of extraneous shells still adhering are dissolved away by muriatic acid and those specimens that look worthwhile are subjected to a bath in diluted clorox (sodium hypochlorite), a household bleaching fluid.

In those geodes found with an opening, which was caused either thru deterioration, or thru rolling about on the shore, it will be noted that the clay has been carried away and the interior filled with more or less sand, and often shells of dead mollusks. One large geode, with a very small opening, was found lying upon the shore filled with water, and in it was a fish five inches long and very much alive. Of course this is all incidental to mineral collecting in this area and is an experience not encountered in other mineral localities.

It is reported that local collectors seldom visit the locality except during a raging storm, at which time they patrol the beach to gather any geodes that may be gouged out of the bottom of the bay and cast upon the shore. The writer has collected after a heavy storm, specimens that have been thrown upon the shore just beyond the normal high tide margin. Geodes that have no opening, or have not been broken, are semi-buoyant and therefore are tossed about by the heavy seas. It was the writer's pleasure to act as escort to a visiting collector whose time was limited to a few hours and who insisted on visiting Ballast Point, altho he was advised that the wind, the tide and the water were all against any success in collecting. Upon arrival at the locality the water was in a turbulant state. It was noticed that several stones, by action of the water, were bouncing back and forth in the waves which were breaking on the shore. These were recovered and they proved to be chalcedony geodes in good condition.

The chalcedony replacement is very hard, ranging from 6.5 to 6.9 in the scale of hardness[15], and the opening up of geodes without damage to the specimen is a problem. The material is so hard that it requires heavy blows to break it and when the cavity gives way under such pounding it is liable to be broken into many pieces. The most successful way in which to open these specimens is with a carborudum disc or other cutting wheel used by lapidaries.

A most interesting specimen, covered with oysters, both dead and alive, was

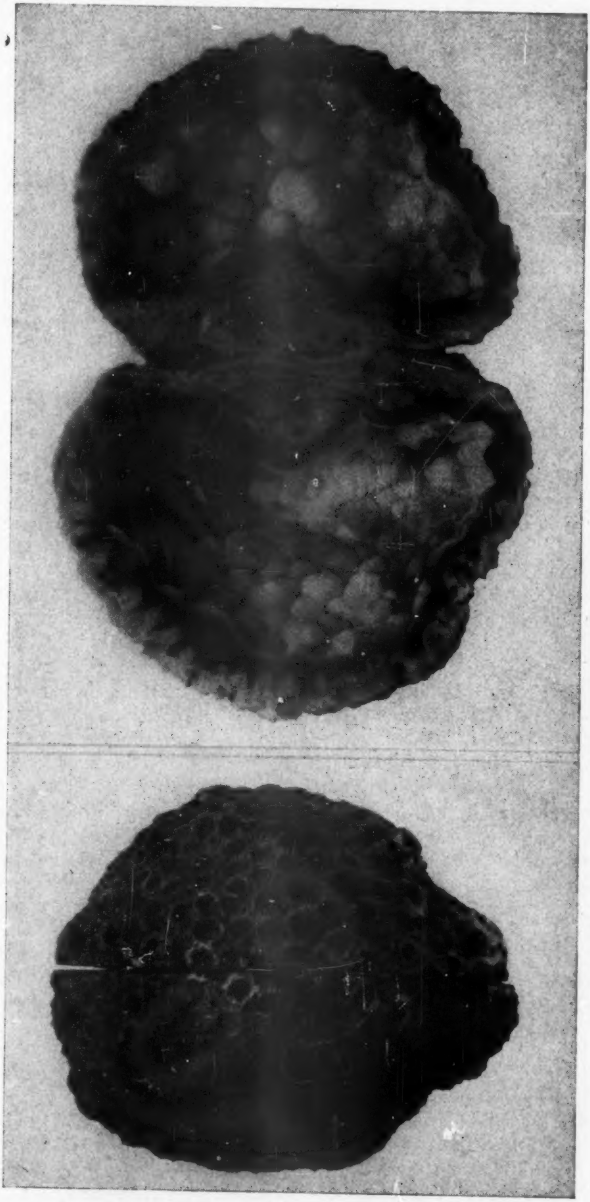

Fig. 7. Chalcedony (variety Sardonyx) pseudomorph after Coral (Orbicella tampaensis Vaughan). Left: Showing cherty exterior and radial structure of the septa within the calicular cavities. Right: Interior of same specimen with corallites partially carried away in solution; also illustrates the familiar botryoidal structure of the Chalcedony. (x4/9).

collected in the littoral zone. After the specimen (Fig. 5) had been cleaned and could be examined it was found to be a part of a coral colony that had been silicified. The specimen shows the position of growth and tubular character of the corallites; this unusual and rare view of a longitudal section in such good condition was made possible by the fact that only a part of the corallum had been silicified, the softer remains of the exoskeleton having been carried away in solution, or scoured by beach sands.

Another specimen (Fig. 8) of the *orbicella* variety of coral with a cherty exterior, was cut open and the enclosed clay removed, exposing a geode lined with black onyx, which, on the surface, had been altered to a bluish or bluish-white color, making an unusually attractive specimen worthy of any cabinet.

Some coral heads are found almost solidly silicified, with very small cavities or recesses in the interior. A good illustration of a solid specimen (Fig. 9) shows an interior consisting of black onyx. Some branching kinds of silicified coral skeletons are found with shallow cavities the outer crusts of which are composed of layered agate (Fig. 10).

A specimen (Fig. 14) of much interest was one showing a pillar-like structure within the cavity. Other geodes have been opened with similar internal structures but the pillar or stalactitic forms were oriented within the geodes in such a manner as to suggest that one or more of the tubular corallities not carried away in solution provided the base for silicification. In this particular specimen, however, the pillar structure is at right angles to the position of the original corallites. A few geodes have been found where a worm borer must have entered the coral skeleton when it was a lime fossil, and silicification has subsequently taken place, using the worm as a base, giving the appearance of a silicified worm suspended across the cavity. This would hardly account for the pillar structure here illustrated.

Some geodes contain stalactitic structure and at times the cause of such structure may be noted in the presence of a silicified shell borer which evidently had perforated the original animal structure when it was a lime fossil and later became silicified with the rest of the skeleton.

The largest geode collected was a coral head of the *orbicella* variety, discovered buried in the clay at very low tide level and with a few square inches exposed. Before the specimen could be removed the tide had turned and it was soon covered with water. While the spot was visited many times it was nearly three months before the water was found low enough to permit the removal of the specimen. Its horizontal circumference is 45 inches, and its vertical circumference is 41 inches. It weighs 80 pounds and is in excellent condition, showing the coral exoskeleton in the minutest detail. As no two geodes are alike the opening of this specimen is looked forward to with interest.

LUMINESCENCE*

Many of the chalcedony specimens collected at Ballast Point fluoresce under the excitation of ultra violet lamps such as the popular so-called "black light," a high wattage electric lamp whose glass envelope serves also as a long wave ultra violet filter passing those wave lengths ranging approximately from 3100 to 4100 A. Some fluoresce a feeble green while others a yellowish-green. A group of cut cabachons of black onyx, sard, carnelian and agate make a very interesting display glowing with a diffuse bluish-and yellowish-green luminescence. Under intense short wave excitation, such as that from the iron spark, some stones phosphoresce for a brief period.

A polished specimen showing broken corallites enclosed in transparent brown chalcedony, variety sard, when subjected to black bulb radiation, exhibits differential behavior in that the enclosed corallites fluoresce apple-green while the chalcedony remains inert.

The simplest and most likely explanation of the cause of the long wave green fluorescence in these chalcedony pseudomorphs, is that it is due to minute

*See Appendix

Fig. 8. Chalcedony pseudomorph after Coral (Orbicella tampaensis Vaughan). Left: Exterior showing part of corallum outlined in chert. Right: Interior of the same specimen lined with Chalcedony, variety Black Onyx, which, on the surface, has been altered to produce a bluish and bluish-white color. (x 2/3).

traces of crude oil being dispersed in the chalcedony, and formed subsequent to the death of the polyp by putrefaction processes. Contributive evidence, too, is the fact that there is no evidence (or expectation) that the pseudomorphs are radioactive, or carry any trace of uranium.

The phosphorescence of the Tampa chalcedony is probably due to a small amount of dispersed residual colloidal calcite, i.e. of the coral skeleton.

SEMI-PRECIOUS STONES

As previously stated the interior of these chalcedony geodes presents a remarkable coloration of the many shades of red, yellow, brown, black, white and blue. Some of these colors penetrate the stone throughout, others are at the point of contact of the chalcedony on the interior with the outer layer of chert,—the color showing thru the almost transparent chalcedony. Other fantastic colors are displayed if the mineral had been subjected to further alteration, which leaves a colorful bloom on the deteriorated surfaces. This superficial coloring has been noted principally on those specimens found broken, or with an opening that has permitted the substitution of the clay by sand and water from without. In some instances the chalcedony has been changed to an opaque mineral of a porcelain-white color called cacholong, a dull variety of opal (Fig. 12).

The mineral chalcedony, as previously noted, comes in a number of varieties and often lends itself to use as a semi-precious stone. Found in the Tampa area are nearly all of the familiar varieties, such as sard, sardonyx, black onyx, carnelian and agate. Similar stones have been known since biblical times and are frequently mentioned in the Bible.

On the occasion of the writer's first visit to Ballast Point he saw the possibilities of these stones for use in the arts and has had many stones cut and polished by the lapidary (Fig. 1). Some of these have been passed on to the metal craftsman to be mounted for use as jewelry. The result has been almost beyond belief, and they are doubly appreciated

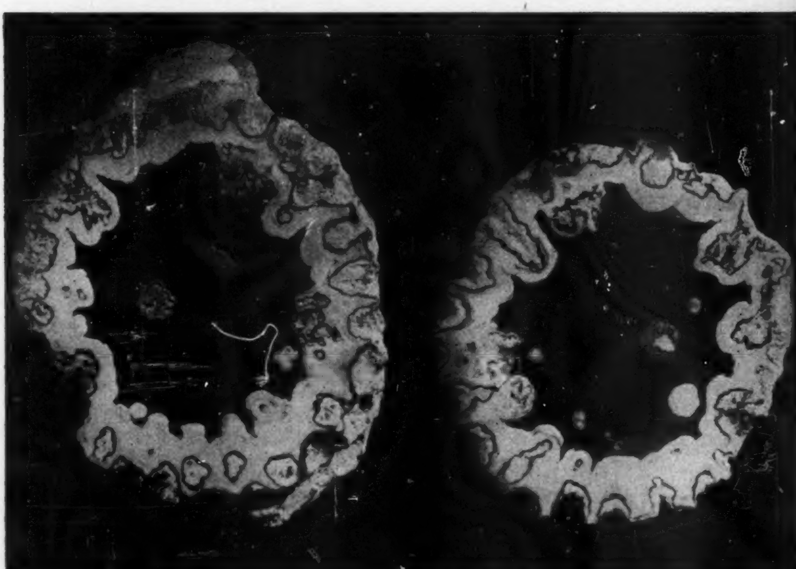

Fig. 9. Chalcedony pseudomorph after Coral (Solenastrea sp). Specimen cut in two to show Black Onyx interior. (x 1 1/5).

when one considers the many processes that have brought forth these creations.

All semi-precious stones are not created in this manner; but, stripped of technical and scientific terms, this is a simple story of how these stones have been produced in the Florida area.

CONCLUSION

The story you have just read of a tiny transparent jelly-like sac swimming about in an ancient sea, being changed to an object of beauty and adornment, has a parallel in literature, which may be of significance. By some marvel of intuition, Shakespeare, in his play THE TEMPEST, puts these words into a song sung by the spirit Ariel, which is quoted in part:

"Full fathom five thy father lies;
Of his bones are coral made;
Those are pearls that were his eyes;
Nothing of him that doth fade,
But doth suffer a sea-change
Into something rich and strange."

Commentators have linked these words to the various accounts of the shipwreck of Sir George Somers' "Sea Venture" off the Bermudas, and the subsequent escape in 1609-1610. The play could not have been very well written prior to 1609, the year of Somers' wreck[16], and it is recorded as coming into existence in 1611. The passage just quoted was probably written by Shakespeare after he had conversed with the wrecked seamen on their return to England in 1610, who undoubtedly told of the wonders of the coral formations they had observed among the islands.

The State of Florida has been blessed by Nature in the distribution of many of the good things in this life; and the writer ventures to suggest, without any ulterior motive, that the mineral chalcedony, found within its borders in so attractive a form, be honored by being designated as the gemstone of that State. The writer knows of no locality of like area in this country that produces minerals of a single species in such a variety and combination of colors; and it may be truly said that the tiny animals that thrived ages ago in Floridian waters have suffered, in the words of Shakespeare, "a sea-change into something rich and strange."

Fig. 10. Chalcedony pseudomorph after Coral (Goniopora sp). Specimen cut in two to show Agate interior. (Actual size).

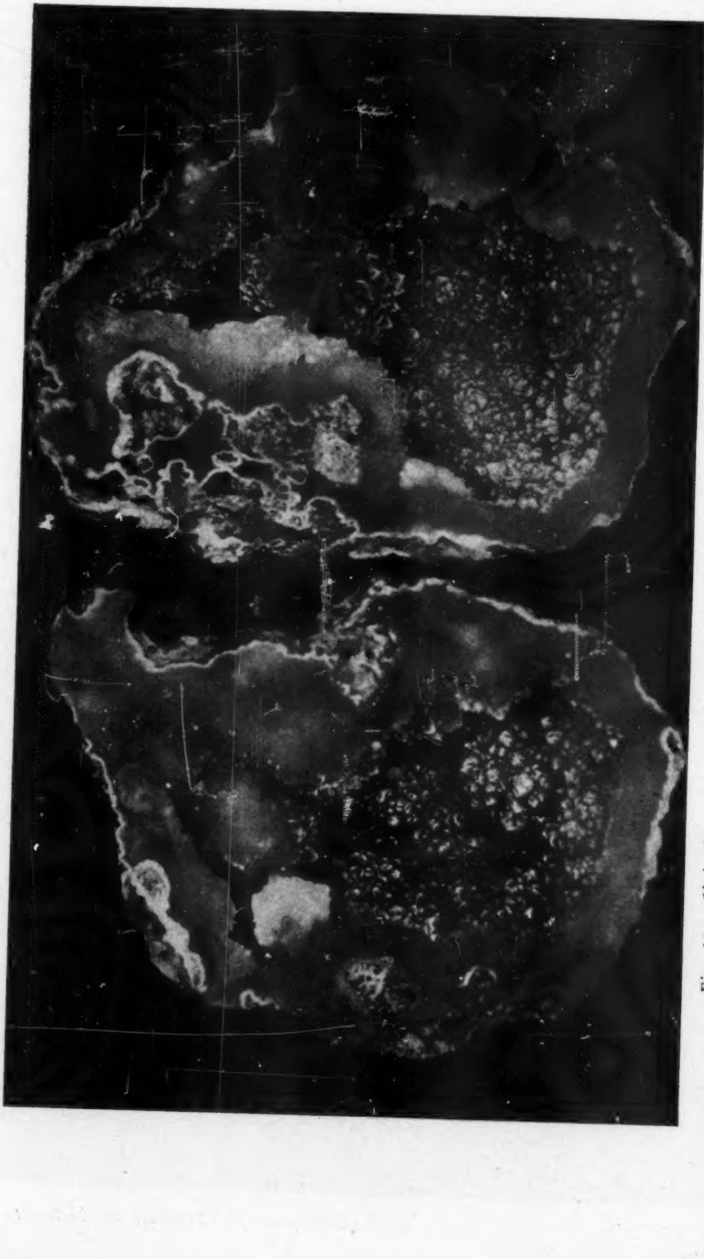

Fig. 11. Chalcedony (*variety Sard*) *pseudomorph after Coral* (*Orbicella tampaensis variety silecensis Vaughan*). *Specimen cut in two to show that corallites have been carried away in solution and the resulting cavity lined with drusy quartz crystals. Crystal terminations have been treated with ammonium chloride for photographic purposes.* (x 8/9).

Fig. 12. Chalcedony altered to Opal (variety Cacholong) pseudomorph after Coral (Orbicella tampaensis variety silecensis Vaughan). Left: Exterior of corallum showing nature of the corrallites. Right: Interior of the same specimen showing corallites carried away in solution and the Chalcedony altered to Cacholong, a dull variety of Opal. (x 1/2).

Fig. 13. Chalcedony pseudomorph after Coral. A—Acropora sp. (x 1/2). B—Solenastrea sp. (x 2/3). C—Goniopora sp., a complete corallum with tips of branches cut away to show Chalcedony, variety Carnelian, interior. (x 3/4).

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Fig. 14. Chalcedony (variety Sardonyx) pseudomorph after Coral (Orbicella tampaensis Vaughan) showing pillar structure within. Origin of this phenomenon not obvious. (x 2/3).

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14 Ibid, p. 4.
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APPENDIX

'abulation of luminescence of various specimens from Ballast Point of Chalcedony pseudomorph after Coral under several types of ultra violet lamps. Observations made by O. Ivan Lee and Joseph D'Agostino, New Jersey Mineralogical Society

(Code: F—Fluorescence P—Phosphorescence)

Spec. No.	ARGON 16 bulbs with aluminum reflectors	IRON SPARK without filter	IRON SPARK with red purple Corex A 986 Corning filter	COLD QUARTZ with red, purple 587 Corning filter
1	Yellowish - green to oil-green F on broken edge. No P.	No F. Weak bluish P.	All fluorescent as under Argon but of yellowish colors instead of greenish.	All fluorescent as under iron spark with 986 filter, but much more intense; without filter various shades of yellow.
2	Pale green F. No P.	No F. Yellowish P.		
3	Slight greenish F. No P.	No F. Faint P, stronger in spots on broken edge.		
4	Deep apple-green F. No P.	No F. Some bluish P.		
5	Various shades of apple-green F in enclosed corallites only. No P.	No F. Yellowish P in enclosed corallites only.		
6	Dark green F. No. P.	No F. Yellowish P.		
7	Apple - green F in part No P.	No F. Yellowish P.		
8	Various shades of apple-green F. No P.	Slight greenish F. Yellowish P.		
9	Cut cabochons: all more or less various shades of apple-green F except those of amber, red or black. No P.	No F. All yellowish P except those of black color.		Various shades of deep yellow to green F except those of black color.

THE COPPER BOULDERWHIP

By RONALD L. IVES

INTRODUCTION

During the progress of field work in almost any mining community, various interesting legends, many of them wild, are learned. Some of these are typical of the great American "tall story," others are legends of actual occurrences, and still others are distorted accounts of misunderstood natural phenomena. These legends, whatever their origin, form a part of American folklore, and should be recorded whenever possible.

Perhaps the most interesting of these legends is the tale of the Copper Boulderwhip, heard in many versions in an equal number of mining camps. Although, at first glance, this could be regarded as a typical "miner's lie", the tale is chemically and psychologically sound, and the chemical reactions responsible for the weird occurrences described are now economically important in a number of copper-mining areas.

"THE COPPER BOULDERWHIP"

"Late in the fall of '76, or maybe it was '86, old Paddy O'Reilly found it was getting kind of cold up on his claim above Tincup, so he lowered all his heavy tools, including his boulderwhip (ten pound iron sledge), into his workings, padlocked the door, and went to town for the winter.

Along about the middle of May, the next year, the snow melted enough so he could find his headframe, so Paddy decided to open his mine again, and maybe strike something better than tobacco-money.

After a couple of days, he got the door uncovered and open, and started to pump his shaft out, which was a wearisome task with the "armstrong" pump he was using.

About a week later, the sump was dry, and Paddy set to work clearing the shaft of fallen slabs. Recovering the boulderwhip left behind the year before, he started to break up the larger rocks, but made little progress, for the boulderwhip mushroomed out as though it were made of putty. To his dismay, he found that it had turned to copper during the winter!

Firmly convinced that the mine was infested with banshees, evil spirits, disembodied souls, or other creatures not found in standard zoological works, Paddy suddenly remembered urgent business in Tincup; broke all records getting there; told his tale at the saloon, where he bolstered his courage at the bar; went to confession, for the first time in twenty-seven years; signed the pledge; and "made tracks for elsewhere."

Some time later, investigation by an incredulous group of miners showed that the boulderwhip actually *had* turned to copper, and the committee adjourned to the saloon muchly perplexed. For some years thereafter, O'Reilly's Gulch was not prospected."

This version, current in Taylor Park, Colorado, on the west side of the Sawatch Range, has approximate counterparts in the San Juan mining regions; and other accounts, similar in plot and context, but not in details, can be heard in many parts of the Rocky Mountains.

Almost identical stories were current in mediaeval Europe, the metallic changes being attributed to the work of *nickels, kobolds,* and other malevolent subterranean entities, whose sole mission on earth, so it seemed, was to harass the miners. It must be remembered that, until recently, workable iron was harder to get, and hence much more expensive, than copper. In consequence, the "transmutation" of an iron tool to one of copper was not just an annoyance, but an economic tragedy.

CHEMICAL BASIS

Although it has been known that iron tools, when exposed to certain types of mine waters, will turn to copper, or acquire a thick coating of copper, for more than two thousand years, the chemical basis for this change has only been worked out in the last century. Actually, a number of reactions are possible, but the most common is:— $CuSO_4 + Fe = FeSO_4 + Cu$.

Mine waters acquire a copper sulfate content when copper sulfides, or other copper minerals and iron sulfide, are oxidized. The reactions tend to be quite complex, in many instances sulfurous acid and sulfuric acid both being formed. The copper sulfite resulting from reactions with sulfurous acid is then oxidized further to make copper sulfate.

These reactions, once attributed to evil spirits, have now been put to work in many mining areas. At Rio Tinto, Spain, copper sulfide ores are exposed to water and air, in the "heap leaching" process, and copper recovered from the waters by precipitation on pig iron. At Butte, Montana, mine waters are passed over masses of detinned scrap, in the famous "Tin Can Smelter", and the copper recovered as a result of this displacement. In consequence, the mine waters, once both a nuisance and a source of stream pollution, are now a source of income.

Numerous other examples could be cited. In a few areas, only by use of leaching and precipitation processes can mines be made to pay. It seems entirely possible that a number of abandoned copper mines, not workable at a profit by ordinary methods, might again be made to pay, although in small amounts, by use of this process. A careful investigation of the old Schuyler copper mines, at Arlington, N. J., seems in order in this connection. Miles of workings, in a well watered copper-bearing area, are known to exist. Within sight are several large cities (New York and Newark), source of scrap iron, which is locally detinned. By passing sump waters from the abandoned Schuyler mine over the waste products of the local detinning plants, copper would be produced. All that remains to be done is a detailed study to determine whether or not it would pay.

TIN DEPOSITS OF NORTH AND SOUTH CAROLINA

Investigations of domestic deposits of strategic minerals by the Geological Survey, United States Department of the Interior, have included the examination, by T. L. Kesler and five assistants, of practically all known tin deposits in the Piedmont section of North and South Carolina. The deposits occur from Lincolnton, North Carolina, southwest to Gaffney, South Carolina, a distance of 36½ miles, and are readily accessible by highways, county roads, and the Southern and Seaboard Railways.

The mineral cassiterite, the dark-brown tin dioxide, occurs in spodumene-bearing pegmatite bodies and closely associated bodies of quartz-muscovite rock called greisen. Where the country rock is of uniform hardness the pegmatite bodies are emplaced in crosscutting joints, but in bedded rocks of contrasting hardness the pegmatite bodies are parallel to the layers.

Although cassiterite is sparsely disseminated in hundreds of these pegmatite dikes and sheets from Lincolnton southwest to the State line, it is abundant enough to be of possible economic importance only in 90 bodies in North Carolina and 1 in South Carolina. Forty of these were measured for maximum thickness. Of these, 21 do not exceed 6 inches, 15 range from 7 inches to 2 feet, and 4 range from 3 to 4 feet. One that was not seen is reported to be 9 feet thick. The maximum strike length is 225 feet, but most bodies range from 25 to 50 feet. The maximum pitch length proved by mining is 200 feet. The bodies are so irregular in shape that the dimensions of their unexposed parts are unpredictable. With few exceptions, the bodies are too widely separated for more than one to be mined in a single operation. No detailed assays are available, but the tin content is known to be very uneven, ranging from a trace to 7 percent of metallic tin.

The examination showed that the bed rock deposits, individually or as a group cannot yield more than small amounts of

(*Continued on page 459*)

Collectors' Tales

CURING A PEST

Some years ago, about 1910 or 11, I had a pest who bothered the life out of me for specimens (this was at the old Gillette quarry at Haddam Neck, Conn., of which I was foreman). I gave him freely as at that time I was not interested much in minerals in general.

The pest, who is still collecting, used to go into the quarry after working hours, sometimes after dark. He had one of the old-fashioned dark lamps, that one could slide a darkener over—I don't believe there were flashlights then. However, he would use this light to look into the cavities or pockets which we had searched through during the day—sneaky-like!

One day my wife happened to break one of those glass pitchers that we used to get with a pound of tea or something. This pitcher had an octagon-shaped handle. An idea struck me. I broke off a piece of this handle, about 1½ to 2" long, took it out to the quarry and cemented it snugly into one of the pockets. I then threw some loose spar dust around it, making sure that enough of the glass was showing and it stood out like a beautiful white crystal!

Next morning the "crystal" was gone and so was the pest as he never showed up again. He must have worked very hard (like H—l) getting this "wonderful" specimen out and when he finally discovered what he had he did not dare to show his face around the quarry again. If he is a reader of *Rocks and Minerals* he will now know the sequence—also that he lost a wonderful opportunity for getting specimens if he had only used the right procedure.

The moral of this story is that a lot of good sports lose out on account of a few selfish folks.

George Wilkes

FIELD FABLES OF "ROCKY" MOORE

I jist run acrost a clippin about Magnetite (magnetic iron) in wich a feller tells it got its naim from sum sheephurder naimed Magnes. He got his iron hurdin-staf prakly jerked outn his hands by the stuff on Mount Ida. Anuther naim fer it is Lodestone and remines me of the time me an Chuck an Waller (thems my burrers) wuz crossin the Beeler Butes, a-lookin fer a lost gold mine. We had riz up outn a wash an wuz scramblin up over a irun deeposit. The burrers wuz amblin bout two hunnert yards ahed uv me whin suddinly I heard a clang an peered up to see all my pots an kittles, skillik an uther utensils pop out uv the pack an hit the ground. Nary a one uv em bounced. I had jist put new shoose on them burrers an they wuz glooed to there traks. I wint up to investigate an immediately got stuk myself by the nales in my shoose. We wuz ankored there fer bout tree days an nites an wuz jist on the virge uv starvashun whin it suddinly okkured to me to take off my shoose. Thet wuz the strongest pullin lodestone I ever saw. I wuz showin it to a tightwad friend uv mine oncet an it drawed off a kuple uv his pance buttins.

Yore's trooly, "Ol' Rocky," Awthur.

Clubs Affiliated With the Rocks and Minerals Association

ARIZONA

Mineralogical Society of Arizona
Geo. G. McKhann, Sec.. 909 E. Willetta Street, Phoenix.
Meets at the Arizona Museum in Phoenix on the 1st and 3rd Thursday of each month.

CALIFORNIA

East Bay Mineral Society
Miss Marjory Welch, Sec., 3268 Central Avenue, Alameda.
Meets on the 1st and 3rd Thursdays of each month (except July and August), at 8:00 p.m., in the Lincoln School Auditorium, 11th and Jackson Sts., Oakland.

Northern California Mineral Society
A. L. Rogers, Sec., 137½ Joost Ave., San Francisco.
Meets on the 3rd Wednesday of the month at the Public Library in San Francisco.

Southwest Mineralogists
Mrs. Pearle Arnold, Cor. Sec., 2132 W. 76th St., Los Angeles.
Meets every Friday at 8:00 p.m. at Manchester Playground, 88th and Hoover Sts., Los Angeles.

COLORADO

Canon City Geology Club
F. C. Kessler, Sec., 1020 Macon Ave., Canon City.
Meets on the 1st and 2nd Saturdays of each month at 9:00 a.m. in the High School Building Canon City.

Colorado Springs Mineralogical Society
Lynn M. Hopple, Sec.-Treas., Motor Route 2, Colorado Springs.
Meets usually at the Lennox House, Colorado College Campus, Colorado Springs, on the 2nd Monday, of each month at 7:30 p.m.

CONNECTICUT

Bridgeport Mineral Club
Mrs. Julia Walker, Sec., 55 Eaton Street, Bridgeport.
Meets in the Bridgeport Public Library on the 3rd Monday of the month.

Long Hill Mineral Club
Eugene F. Robinson, Sec., R. F. D. No. 4, Box 237, Bridgeport.
Meets on the 4th Tuesday of each month at 8:00 p.m., in the Hawley Memorial Library, Long Hill.

Mineralogical Club of Hartford
Mrs. L. T. Goodrich, Sec., 51 Jerome Avenue, Bloomfield.
Meets the 2nd Wednesdays of each month, at 8:00 p.m., at 249 High St., Hartford.

New Haven Mineral Club
Mrs. Lillian M. Otersen, Sec., 16 Grove Place, West Haven.
Meets on the 2nd Monday of the month at the Y. W. C. A. on Howe St., New Haven.

IDAHO—OREGON

Snake River Gem Club
Margaret L. Hearn, Sec., Payette, Idaho.
Meets alternately in Payette and Ontario, Oregon, (two small cities on the Snake River) on the 3rd Tuesday of every month.

ILLINOIS

Junior Mineral League
E. Johansen, Sec., Morgan Park Junior College, 2153 W. 11th St., Chicago.

MAINE

Maine Mineralogical and Geological Society
Miss Jessie L. Beach, Sec., 6 Allen Avenue, Portland.
Meets last Friday of the month at 8 p.m., at the Northeastern Business College, 97 Danforth Street, Portland.

MARYLAND

Natural History Society of Maryland
2103 N. Bolton Street, Baltimore.
Office hours, Tuesdays and Fridays, 10:00 a.m. to 5:00 p.m.

MASSACHUSETTS

Connecticut Valley Mineral Club
Leo D. Otis, Sec., 12 Clark St., Westfield, Mass.
Meets on the 1st Tuesday of each month at 8 p. m. at various institutions in the Connecticut Valley.

MISSOURI

National Geologist Club
Mrs. D. P. Stockwell, Pres., Mt. Olympus, Kimmswick.

NEVADA

Reno Rocks and Minerals Study Club
Mrs. Rader L. Thompson, Sec., Box 349, R2, Reno.
Meets on the 1st Wednesday of each month, at 7:30 p.m., at the Mackay School of Mines, Reno.

Western Nevada Mineral Society
A. Cornely, Sec.-Treas., P. O. Box 21764, Reno.

NEW JERSEY

Newark Mineralogical Society
William E. Simpson, Sec. 308 Grove Street, Montclair.
Meets on the 2nd Sunday of the month at 3 p.m. at Junior Hall, corner Orange and North 6th Streets, Newark.

New Jersey Mineralogical Society
O. B. J. Fraser, Sec.-Treas., 27 Stoneleigh Park, Westfield.
Meets on the 1st Tuesday of the month at 8 p.m. at the Plainfield Public Library.

NEW MEXICO

New Mexico Mineral Society
R. M. Burnet, Sec.-Treas., Carlsbad.

Society of Archaeology, History and Art
Carlsbad.

NEW YORK

Chisiers, The
Miss Evelyn Waite, Sponsor, 242 Scarsdale Road, Crestwood, Tuckahoe.

Queens Mineral Society
Mrs. Edward J. Marcin, Sec., 46-30—190th Street, Flushing.
Meets on the 2nd Thursday of the month at 8 p.m. at 289 Etna Street, Brooklyn.

OKLAHOMA

Oklahoma Society of Earth Sciences
W. P. Smiley, Sec.Treas., 229 W. Jefferson Street, Mangum.
Meets on the 2nd Tuesday of each month, at 7:30 p.m., at the Historical Museum, Mangum.

PENNSYLVANIA

Thomas Rock and Mineral Club
Mrs. W. Hersey Thomas, Pres., 145 East Gorgas Lane, Mt. Airy, Philadelphia.
Meets on the 3rd Friday of each month, at 8:00 p.m., at the home of its president, Mrs. Thomas.

VERMONT

Mineralogical Society of Springfield
Victor T. Johnson, Sec., 11 Elm Terrace, Springfield.
Meets on the 3rd Wednesday of each month at 8:00 p.m. at the homes of members.

WASHINGTON

Gem Collectors Club
Mrs. Lloyd L. Roberson, Sec., 522 North 70th Street, Seattle.
Meets on the 1st and 3rd Tuesday of each month (except during the summer) at 8:00 p.m., at the Y. M. C. A.

Washington Agate and Mineral Society
Monroe Burnett, Sec., 802 S. Central St., Olympia.
Meets on the 1st Monday of the month, at 7:30 p.m. at the home of some member.

Collectors' Kinks

A "PAINTED" IDEA

We learn from experience but it is not always that we put this in practice. There is one collector known to us who has done so—he is Mr. M. D. Bogart, of Wellesley, Mass.

Mr. Bogart has lost a number of hammers and chisels at mines and quarries because, when placed on the ground, the tools, being inconspicuous, were often overlooked and left behind. He now paints all his tools a bright canary yellow. Now even a small chisel, if painted yellow, can be spotted a hundred feet away.

This is a very good idea—paint your tools a bright color so that they may be easily spotted if laid on the ground.

TIN DEPOSITS

(*Continued from page 456*)

tin. Possible a few can be mined profitably on a small scale if the price of tin rises sufficiently. How little the deposits are likely to yield is suggested by their recorded production of only 300 tons of tin since their discovery in 1883. Small placer deposits, three of which are known, and thin layers of cassiterite-bearing soil of no very great extent contain altogether perhaps 150 tons of metallic in.

Club and Society Notes

New York Mineralogical Club

American Museum of Natural History, New York, N. Y., Wed., Nov. 5, 1941 (Special Meeting)

The meeting was called to order at 8:15 P.M., by the presiding officer, Mr. John N. Trainer, with 44 members and guests attending.

Mr. Trainer reminded the members of the dinner before each meeting at the Planetarium restaurant.

Mr. Grahl announced the fall excursion to the Strickland Quarry at Portland, Conn., on Sunday, November 9th and gave a list of the minerals to be found there.

Mr. Northup asked that all members notify him of any change of address.

Mr. D'Agostino again announced the exhibition to be given by the New Jersey Mineralogical Society during the week starting Saturday, November 15, in the Public Library at Plainfield, New Jersey.

Mr. Trainer then introduced the speaker, Mr. E. A. Maynard, who spoke on the subject "Rambling through the West."

His talk was illustrated with splendid color slides of scenery, wild flowers and some of the mineral specimens obtained on the trip. He also exhibited the specimens themselves among them being excellent:—

Shattuckite, Wulfenite, Dioptase, Chalcedony pseudomorphs, Azurite, Malachite, Vanadinite, Barite and Thunder eggs.

Dr. Pough announced that the School Nature League is making an appeal for small mineral and rock specimens for use in the city grammar schools and urged the club to cooperate.

The meeting was adjourned at 9:15 P.M. to permit the members to examine the specimens and partake of refreshments.

M. Allen Northup, Secretary

Southern Nevada Rock Hound Society

A new rock-collectors club is in process of formation, to be known as the Southern Nevada Rock Hound Society, which plans field trips, group rock cutting and polishing, swapping information, etc.

Semi-monthly meeting will be held, alterating between Las Vegas and Boulder City, and we would like to hear from all people interested in Southern Nevada and adjacent sections of Arizona. Call or write Paul Mercer, 624 Ave. D, Boulder City, Nevada.

Northern Ohio Guild

Members of the Northern Ohio Guild of the American Gem Society enjoyed a varied and interesting program during their November meeting in Western Reserve University, Cleveland, Ohio.

Dr. Donner divided his lecture into two parts, one being for the newer students and the other for advanced students and certified gemologists.

In line with a new policy advocated by Charles Carolyne, Guild President, a number of cut Topaz Quartz in numbered papers were passed around the class for the individual members to judge for variation in color, cutting and carat value.

Gordon Davis, of the Editorial Staff of the *Cleveland Press*, who has been attracted by the scientific and educational work being done by the Guild, attended as a special guest with the intention of gathering material to be used in a feature newspaper article. Pictures were taken by Raymond Hoover, of Akron, showing members of the Guild using the Diamondscope and Diamolite ,and other instruments for release in conection with the article.

The next evening will also be held in Western Reserve University on Monday evening, December 1st.

New Jersey Mineralogical Society

A regular meeting of the Society will be held on Tuesday, December 2, at 8:00 p.m., in the Plainfield Public Library, Plainfield, N. J. The program will be devoted to a mineralogical quizz patterned after Radio Quizz Programs. Fifty crystal and gem specimens, 50 prominent mineralogical names, and 50 mineralogical and geological terms will be offered. There will be prizes.

Bibliographical Notes

Petroleum and Natural-Gas Fields in Wyoming: By Ralph H. Espach and H. Dale Nichols.

Wyoming contains many petroleum and natural-gas fields but not all of them are of commercial importance. This interesting report of 185 pages and 72 figures and maps (55 are in a sepaarte case) should be of special value to those desiring information on these important mineral products of the state.

Issued by the U. S. Bureau of Mines as Bulletin 418. For sale by the Superintendent of Documents, Wahington, D. C. Price $2.25.

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